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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/025,683	12/26/2001	Yoshiaki Shimooka	P 290492 T7TA-01S1001	6041
7590 11/03/2003 pillsbury winthrop llp 1600 tysons boulevard mclean, VA 22102			EXAMINER ESTRADA, MICHELLE	
			ART UNIT 2823	PAPER NUMBER

DATE MAILED: 11/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/025,683	<b>Applicant(s)</b> SHIMOOKA ET AL.	
	<b>Examiner</b> Michelle Estrada	<b>Art Unit</b> 2823	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 28 August 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
- 4a) Of the above claim(s) 21-36 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
     If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
     a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
     a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>3</u> | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election of Group I (claims 1-20) in Paper filed 8/28/03 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 8 and 18 recite the limitation "sulfur in said insulating layer" in line 2 respectively. There is insufficient antecedent basis for this limitation in the claims.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Dubin et al. (5,891,513) and Dubin et al. (6,491,806).

Dubin et al. ('513) disclose a Cu-based wiring layer (22) containing a Cu-based metal as a main component and formed on a surface of a semiconductor substrate; and an insulating layer (12) formed to surround said Cu-based wiring layer; wherein said Cu-based wiring layer is formed inside a wiring groove (15) which is formed in said insulating layer (See fig. 4); wherein a conductive diffusion-prevention layer (20) is formed on an inner surface of said wiring groove; wherein said conductive diffusion-prevention layer contains Ta or TiN (Col. 5, lines 54-55); wherein an insulating diffusion-prevention layer (30) is formed on an upper surface of said Cu-based wiring layer which is formed in said wiring groove (Col. 8, lines 53-60); wherein said insulating diffusion-prevention layer consists of SiN (Abstract).

Dubin et al. ('513) do not disclose wherein said Cu-based metal contains sulfur at a ratio ranging from  $10^{-3}$  atomic % to 1 atomic %.

Dubin et al. ('806) disclose a Cu-based wiring layer wherein said Cu-based metal contains sulfur (Col. 7, lines 23-25).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of '513 and '806 to enable formation of the copper wiring layer.

Choice of a particular concentration of sulfur and the parameter that determines the permittivity of the insulating layer would have been a matter of routine optimization. See MPEP 2144.05. In addition, the selection of the sulfur concentration, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve

unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed sulfur concentration and the parameter that determines the permittivity of the insulating layer or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen sulfur concentration and the parameter that determines the permittivity of the insulating layer or upon another variable recited in a claim, the Applicant must show that the chosen sulfur concentration and the parameter that determines the permittivity of the insulating layer are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Dubin et al. (5,891,513) and the following comments.

Dubin et al. ('513) disclose a Cu-based wiring layer (22) containing a Cu-based metal as a main component and formed on a surface of a semiconductor substrate; and

an insulating layer (12) formed to surround said Cu-based wiring layer; wherein said Cu-based wiring layer is formed inside a wiring groove (15) which is formed in said insulating layer (See fig. 4); wherein a conductive diffusion-prevention layer (20) is formed on an inner surface of said wiring groove; wherein said conductive diffusion-prevention layer contains Ta or TiN (Col. 5, lines 54-55); wherein an insulating diffusion-prevention layer (30) is formed on an upper surface of said Cu-based wiring layer which is formed in said wiring groove (Col. 8, lines 53-60); wherein said insulating diffusion-prevention layer consists of SiN (Abstract).

Choice of a particular concentration of fluorine and the the parameter that determines the permittivity of the insulating layer would have been a matter of routine optimization. See MPEP 2144.05. In addition, the selection of the sulfur concentration, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233


(CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).


Note that the specification contains no disclosure of either the critical nature of the claimed fluorine concentration and the parameter that determines the permittivity of the insulating layer or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen fluorine concentration and the parameter that determines the permittivity of the insulating layer or upon another variable recited in a claim, the Applicant must show that the chosen fluorine concentration and the parameter that determines the permittivity of the insulating layer are critical. In re Woodruf, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Estrada whose telephone number is (703) 308-0729. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
MEstrada  
October 14, 2003

  
George Fourson  
Primary Examiner  
Art Unit 2823